Abstract No. chen677

Characterization of STGS As-Grown Crystal by Synchrotron White Beam X-ray Topography

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Beamline(s): X19C

Introduction: The use of mobile communication equipment has rapidly expanded worldwide. The new digital mobile communication systems will need to operate at higher frequencies, have wider bandwidth and higher bit rates. To fulfill this need and ensure the high performance, the electric devices, such as surface acoustic wave (SAW) and bulk acoustic wave (BAW) devices, require strong piezoelectric materials which posses the piezoelectric properties intermediate between those of quartz and $LiNaO_3$ and $LiTaO_3$. STGS is one of the new possible candidates recently synthesized from LGS, LGT and LGN crystal family. X-ray topography of the surface of as-grown boule enable one to observe the true microstructure developed during the crystal growth process, and is imperative for understanding the nature and distribution of imperfections.

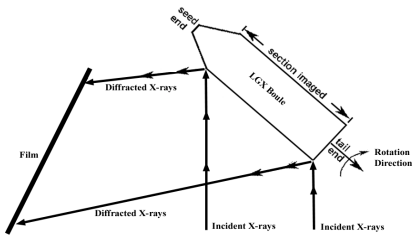

Figure 1. Schematic diagram of reflection geometry.

Methods and Materials: STGS single crystal boule was grown by Czochraksi method. The curved surface of the STGS boule was examined by SWBXT with reflection geometry, shown in Figure 1. Topographs were recorded covering the entire length of the boule in longitudinal strips. After imaging of one strip of surface, the boule was rotated by a few degrees in a clockwise direction, the next strip of surface was imaged.

Results: There is no clear striation contrast can be observed in most of the topographs recorded from the reflection geometry, Figure 2. Wavy contrast features, A, are caused by the ridges on the surface running along the length of the boule. And possible precipitate contrast, P, can also be observed throughout the whole length of boule, Figure 3. Other contrast due to surface roughness can also be observed, Figure 3. In the facet area, vertical white contrast features, F, observed in (a) to (f) in Figure 1, are produced due to risers on faceted steps on the boule (the facets have (0001) orientation), which block the diffracted beam thereby causing bands of white contrast. Some striation-like contrast can be observed in the facet area, but, in this case, it is not clear if it is from striations or due to surface features, Figure 4.

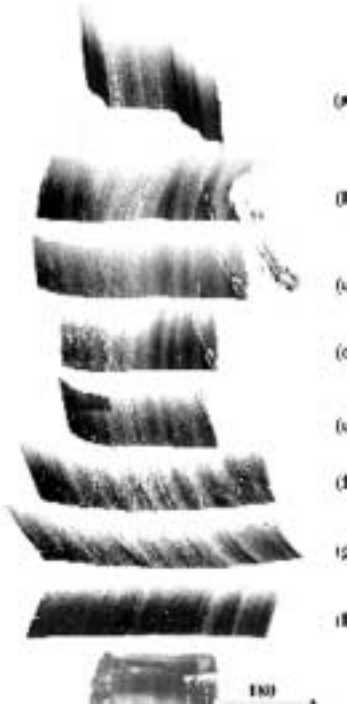

Figure 2. SWBXT images of STGS Boule recorded from reflection geometry

Conclusions: Surface X-ray topography of STGS boule was successfully carried out. Defects, such as precipitates can be observed. No clear striation contrast can be observed. Topographs are dominated by contrast related to surface features.

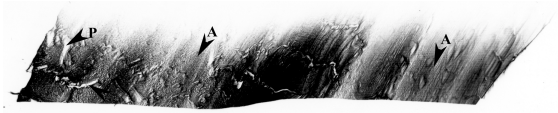

Figure 3. X-ray topograph showing no striations contrast, precipitates, P, wavy surface feature, A, and other surface features can be observed.

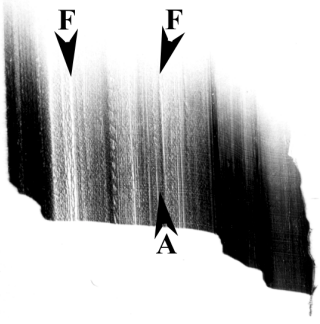

Figure 4. X-ray topograph showing wavy surface feature, A, and vertical white contrast facet features, F, along with some striation-like contrast.